



Medicinal Crops as a Pathway to Sustainable Agriculture, Food Security, Farmers' Income, and Sustainable Development in Pakistan

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ABSTRACT

Agriculture is a backbone of Pakistan's economy, playing a key role in national progress and rural incomes. The State Bank of Pakistan BSC has made substantial role to wide-ranging agricultural funding. Directed by SBP BSC Vision 2028, the Bank has indorsed financial enclosure through subsidized arrangements and targeted capacity-building programs aimed at empowering smallholder farmers, women businesspersons, and rural societies. This paper not only explores the cultivation and commercialization of key medicinal crops in Pakistan but also underscores the importance of institutional and policy support in unlocking their full potential. "Five medicinal crops have been analyzed in this study: [Turmeric. Black Seed (Kalonji), Aloe Vera, Fennel and Mint], each selected for their economic, health, and environmental benefits." The analysis provides a comprehensive overview of their growth conditions, market potential, and contribution to sustainable agricultural practices. It concludes with actionable recommendations aligned with the United Nations Sustainable Development Goals (SDGs), mainly No Poverty (SDG 1), Zero Hunger (SDG 2), Good Health and Well-being (SDG 3), ,Decent Work and Economic Growth(SDG 8), Responsible Consumption and Production (SDG 12), and Climate Action (SDG 13)—positioning medicinal crops as a strategic pillar of Pakistan's green economic future.

Keywords: *Climate Change, Medicinal Crops, Sustainable Agriculture, Sustainable Development Goals, Commercialization of Key Medicinal Crops.*

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1. Introduction

For herbal medicines to be preserved, safe, and widely used, ethnobotanical appraisal of medicinal plant species is necessary. The physical culture of many indigenous communities around the world is heavily influenced by plants and plant-derived goods. The practice of extracting and processing medicinal plants to treat illnesses has existed since the dawn of human civilization. It also helps economic elevating of underprivileged regions.

Agriculture constitutes the major sector of Pakistan's economy. A large portion of population of Pakistan (approximately 68%) directly or indirectly, reliant on this sector. It accounts for half of the working population, contributes around 24% of GDP, and is the primary source of foreign exchange earnings.

It fulfills the food requirement of both rural and urban population (Pakistan Bureau of Statistics <https://www.pbs.gov.pk/content/agriculture-statistics>) and contributing to food security. But problems climate change and low crop diversity put at risk to sustainable agricultural progress. In this perspective, medicinal crops provide a potential substitute to traditional farming. These crops not only enhance biodiversity and environmental sustainability nevertheless also have high market worth, increasing farmers' income and supporting economic stability.

In recent years, recognizing the potential of non-traditional agriculture, the State Bank of Pakistan (SBP)—through its Banking Services Corporation (BSC)—has taken proactive steps to foster crop diversification and inclusive financing. This includes promoting financial products tailored for sectors like medicinal crop farming, supporting entrepreneurship, and facilitating government-led schemes aimed at uplifting rural communities. These strategic interventions are in line with the Bank's broader commitment under Vision 2028 to drive sustainable economic development and rural empowerment.

Around the world, medicinal plants have a big impact on the earnings of the impoverished. Approximately 10% of the approximately 32,000 kinds of higher plants (Prance, 2001) are used in medicine. By 2050, the global medicinal plant industry is predicted to generate \$5 trillion in

revenue (Shinwari, 2010). The majority of people live below the poverty line and carelessly use natural resources to supplement their meager earnings, which is one of the major factors of biodiversity damage.

Scope

Medicinal plants are generally used as traditional medicine in developing or underdeveloped countries, mostly because they are easily obtainable and inexpensive than modern medicines. However, in developed countries medicinal plants are also used, people suffering from the side effects of allopathic or, attempt to discovery solution in Botanical medicine. Many non-steroidal medicines reason deaths and hospitalizations in the America yearly.

Approximately 5% of patient mortality in American hospitals are attributed to drug side effects, which account for 3% to 12% of hospitalizations in Sweden. Moreover, fatal adverse drug reactions rank as Sweden's sixth leading cause of mortality (Nature, March 17, 2008). Although old-style medicine is not proper planned in various countries, the World Health Organization maintains a system to ensure its secure and practical use. Botanical medicine is a poorly regulated sector that includes pseudoscientific items that lack scientific evidence to support their claims. [4] Threats to herbal plants include habitat loss and climate change, as well as the potential for over-collection to satisfy consumer demand.

Pakistan covers a total area of 881,913 square kilometers, situated between longitudes 60° 55' to 75° 30' E and latitudes 23° 45' to 36° 50' N. The country is renowned for its unique geography, featuring the Hindu-Kush Himalayas and the Karakoram mountain range, which results in altitudes that vary from 0 to 8,611 meters. This geographical diversity contributes to a wide range of climatic zones and a rich array of biodiversity (Shinwari & Qaiser, 2011). Pakistan is home to over 6,000 species of higher plants, with an estimated 600 to 700 varieties utilized for medicinal purposes. Approximately 12% of the flora is employed in medicine, and many plants are exported. The country has around 130,000 homeopaths and 39,584 practitioners of traditional medicine (hakims). There are between 300 and 350 companies engaged in the manufacturing of

Herbal/Tibb-e-Unani products, alongside about 300 firms producing homeopathic medicines. Pakistan is recognized as a significant exporter of medicinal plants (Hussain et al., 2009). It is determined that about 70% of the kinds of plant are region-specific, while approximately 30% are dual -regional or multi-regional. The country is

divided into four botanical regions : (i) Indian element (6%); (ii) Saharo-Sindian (9.5%); (iii) Irano-Turanian (45% of species) and (iv) Sino-Himalayan (10%). In spite of the Saharo-Sindian area being the largest, it exhibits the lowest species diversity among all phytogeographical areas (Ali and Qaiser, 2009).

Table 1: Total Vegetation and medicinal plants of the flashpoints of Pakistan and their present position.

Area	Size of Vegetation (No of kinds)	Total no. of medicinally important kinds	Threatened Vegetation (No. of kinds)
Kashmir	1,500	900	200
Sindh	1,185	700	100
Swat	1,550	500	87
Chitral	± 1,600	800	150
Kurram Agency	1,200	>600	>100

Source: Shinwari, Z. K. (2010). Medicinal plants research in Pakistan. *J Med Plants Res*, 4(3), 161-176.

Medicinal Crops in Pakistan

Table 2: Medicinal Crops and their use in diseases

Sr. No	Crop	Uses in diseases
1	Turmeric	Anti-inflammatory, antioxidant, liver health
2	Black Seed (Kalonji)	Immunity booster, diabetes management
3	Aloe Vera	Skincare, digestion, wound healing
4	Fennel	Digestive aid, respiratory health
5	Mint	Digestive aid, flavoring agent

Table 3:

Sr. No	Crop	Cultivate Area in Pakistan	Market Demand
1	Turmeric	Haripur ,Bannu, and Pubbi area of Khyber Pakhtunkhwa and Kasur, Okara ,Lahore and Sialkot, and Sahiwal area of Punjab Mirpurkhas and Sanghar in Sindh	High (local & international)
2	Black Seed (Kalonji)	Faisalabad, Multan, Bahawalpur area of Punjab; Swat, Mardan, Charsadda, areas Khyber Pakhtunkhwa; Hyderabad, Nawabshah, Khairpur areas of Sindh; Quetta, Zhob, Kalat areas of Balochistan	High
3	Aloe Vera	Punjab, Sindh, Balochistan	High (local & international)
4	Fennel	Punjab, Khyber Pakhtunkhwa	Moderate
5	Mint	Punjab, Khyber Pakhtunkhwa	High

Commercialization

There are three features of market need, specifically, quality of product, distribution network, and financial benefits.

a) Market need.

The ongoing supply of raw materials, driven by the rising demand, is a crucial factor in the promotion of medicinal plants. This issue primarily relates to the accessibility of raw materials and agricultural activities, which are linked to post-harvest techniques, appropriate market channels, and the supply chain. Additionally, the cyclical boom-and-bust trends represent a significant challenge for medicinal plants, indicating an unstable situation where initial yields are overshadowed by a decrease in resource availability.

b) Quality of Product

The quality of a product is crucial for ensuring the security and effectiveness of botanical medicines, as well as for fostering customer trust, reliability, and minimizing risks. Essentially, challenges related to quality improvement and market accessibility exist within the realm of medicinal botanicals, from wild harvesting or cultivation to the end users. Quality standards and Good Manufacturing Practices (GMP) are critically required in the international market.

c) Distribution channels

Regarding distribution channels, there are two categories of participants that vary based on products and market chains: upstream and downstream members. Upstream members include input suppliers, primary producers, processors, agents, and vendors, while downstream members consist of producers, suppliers, herbal practitioners, vendors, and consumers.

In Pakistan, the system is simpler, including gatherers, middlemen, dealers, and exporters. Generally, various studies stress that middlemen incline to control the chain. This supremacy results in price inflation and margin disparity. Though, Market change forces must also be taken into account for example variations in demand, infrastructure advancement, and involvements of government.

Financial Benefits

Numerous studies associate fluctuations in income with the commercialization of medicinal plants. For instance, in India, the combined value of two cultivated species, *Saussurea lappa* and *Picrorhiza kurrooa*, reaches USD 11,000 annually. In contrast, Pakistan generates a total income of USD 353,045 from *Morchella esculenta* and USD 353,045 million from 23 other notable species.

Turmeric

Turmeric is a vibrant, golden-orange spice recognized for enhancing the color, flavor, and nutritional value of various dishes. It is cultivated annually in sandy or clayey loam soils across Pakistan, with the optimal sowing period occurring from mid-March to April and harvesting taking place in October to November. To achieve better yields under organic farming conditions, it is advisable to apply 5 to 6 tonnes of Farm Yard Manure per acre. The irrigation requirements typically range from 20 to 40 applications, depending on soil characteristics. The primary districts in Punjab for turmeric production include Kasur, Okara, Lahore, and Sialkot, while Bannu and Haripur in Khyber Pakhtunkhwa, along with Mirpurkhas and Sanghar in Sindh, are also significant contributors. Notably, Kasur accounts for approximately 72 percent of the total turmeric output. The Pakistan Agriculture Department advocates for the cultivation of the "MEHAK" variety, which offers superior yields and a Curcumin content exceeding 3 percent, a quality that may diminish if not handled correctly during processing and drying. On average, farmers can expect to harvest 20 to 25 tons of rhizomes per acre. The harvesting process involves excavating the rhizomes, which are then cleaned and washed. A portion is set aside for future planting, while the remainder is processed into turmeric powder. The raw turmeric undergoes several stages before it reaches consumers.

To mature its characteristic yellow color and fragrance, the gutted rhizomes are boiled for one hour in mildly alkaline water. Thereafter, they are desiccated either by artificial means or in daylight for 6 to 8 days. Though, drying turmeric in exposed arenas, as is common practice among many agriculturalists, carries many risks. Organically, there is a threat of infectious contamination, whereas chemically, insecticide

remains may be in the field and can blend during the drying procedure. Lastly, the dried rhizomes are refined to improve their appearance and color. Turmeric carries several health benefits, with helping digestion, indorsing fat burning, enhancing immune system, enlightening skin complexion, and supporting overall health.

Processing Issues

The processing of turmeric in Pakistan confronts numerous challenges that hamper product quality, market attractiveness, and export chances. Old-style processing procedures including boiling, drying, and polishing are normally conducted manually using outdated methods.

Rough and inappropriate drying procedures cause fungus, decay, and post-harvest wastages, whereas insufficient storage lessens color, smell, and medicinal worth.

The low quality standards—for example examination curcumin amount or wetness levels—weakens purchaser trust. Mostly turmeric is sold unbranded, without proper value addition, missing chances for high-value products. Small processors do not afford up-to-date equipment and depend on manual devices that reduce quality. Moreover, inadequate skill in sanitation, wrapping, and tagging halts the industry from fulfilling global standards and approaching global markets.

Black Seed (Kalonji)

Nigella sativa L., generally referred as black seed or Kalonji, is an annual scented herb natural to Southwest Asia and the Mediterranean. As a member of Belonging Ranunculaceae family, it raises 20–60 cm high and produces small, black, perfumed seeds protein rich, carbohydrates, fats, vitamins, minerals. Kalonji is extensively used in traditional medicine such as Unani and Ayurveda in treatment respiratory, digestive, immune, and inflammatory illnesses. It is renowned for its antihypertensive, antidiabetic antimicrobial, anti-inflammatory, and antitumor effects. It also helps lactation, digestion, and skin treatment, and is used in cooking. In Islamic tradition, Kalonji has significant medicinal worth, with a saying accredited to the Holy Prophet Hazrat Muhammad (PBUH) stress its curative properties. In Pakistan, while extensively used, its farming is not up till now marketed. Though, it carries great potential for sustainable farming, crop variation, and rural income generation.

Actions taken by institutions such as National Agricultural Research Centre (NARC)) purpose to reservation and use Kalonji for wider agrarian and medicinal purposes. But, more consideration is required toward its genetic upgrading and large-scale farming to fulfil increasing medicinal demand.

Table 4: *Production technology of NARC-Kalonji.*

Cultural practice	Requirements
Soil:	Fertile; Mera soil
Soil preparations:	3-4 ploughings along-with Suhaga
Time of sowing:	October to November
Method of sowing:	Broadcasting; Line sowing; Ridges
Seed rate:	4-5 kg/acre
Row spacing:	1½ feet (45 cm)
Irrigations:	4 to 5 per growing season
Hoeing:	1-2 Weedings
Harvesting:	April to May
Potential yield:	Up to 400 kg/acre

Source: Rabbani, M. A., Ghafoor, A., & Masood, M. S. (2011). NARC-kalonji: an early maturing and high yielding variety of *Nigella sativa* released for cultivation in Pakistan. *Pak. J. Bot*, 43, 191-195

Sustainable Agriculture

Kalonji is a perfect crop for endorsing sustainable agriculture in Pakistan because of its low input needs and ecological resilience. It is resilient and dryness resistance, needing nominal use of fertilizers and insecticides, which makes it appropriate for eco-friendly agricultural activities, mainly in arid and semi-arid areas. Its contribution in crop divergence is also important, as integrating kalonji in crop revolutions expands soil fertility, pauses pest cycles, and decreases the dangers related with monoculture agriculture.

Food Security

Seeds of kalonji are rich in important fatty acids, amino acids, and antioxidants, converting them a valued nutritional supplement that boosts domestic nourishment. As a useful food, kalonji contributes to disease prevention, mainly for situations connected to irritation and immunity, so reducing the load on healthcare systems and endorsing long-term community well-being.

Increase in farmers' income.

Kalonji also offers hopeful paths for increasing farmers' revenue. It receives high market demand both locally and globally, especially in the herbal, pharmaceutical, and cosmetic sectors. The potential for value addition—through the production of cold-pressed kalonji oil, dietary supplements, and natural cosmetic products—creates opportunities for small-scale enterprises and rural entrepreneurship. Additionally, given the global rise in demand for organic and herbal products, Pakistan can capitalize on export potential, contributing to foreign exchange earnings and economic development. By integrating kalonji into mainstream agriculture, Pakistan can take meaningful steps toward a more sustainable and inclusive agro-economy.

Aloe Vera

Aloe vera is a renowned medicinal plant that flourishes in a variety of agro-climatic conditions. Originally from Northern Africa, it is now extensively found across the globe. The plant's chemical composition includes a range of biologically active compounds that are linked to the treatment of numerous health issues, including wounds, inflammation, cancer, diabetes, ulcers, microbial infections, skin disorders, acquired

immune deficiency syndrome (AIDS), liver ailments, dental issues, cardiovascular diseases, hyperlipidemia, and more. Additionally, Aloe vera exhibits anti-aging, antioxidant, laxative, and immunomodulatory characteristics. The diverse biological activities are primarily attributed to the various compounds found in the sap and gel of Aloe vera. Research has demonstrated that the anthraquinones and glycosides in the sap play a crucial role in reducing the seriousness of cancer, combating free radical activity, managing diabetes, alleviating irritation, addressing bacterial infections, inhibiting tyrosinase action, enhancing spermatogenic action, and proliferative effects. Furthermore, it influences estrogen levels and intestinal cell absorption while providing laxative effects. Beyond its medicinal benefits, the gel is also a key component in numerous cosmetic products.

In the context of Pakistan's agricultural economy, Aloe Vera stands out as a low-input, high-value medicinal crop that aligns with the goals of sustainable agriculture, food and nutritional security, and rural economic uplift.

Aloe Vera and Sustainable Agriculture

Aloe Vera stands out as a promising medicinal crop that aligns well with the goals of sustainable agriculture in Pakistan. Its drought-resistant nature and minimal water and input requirements make it highly suitable for cultivation in arid and semi-arid regions such as Tharparkar, Cholistan, parts of Balochistan, and southern Punjab. By introducing Aloe Vera into mono-cropped regions, farmers can promote agrobiodiversity and enhance ecological balance. Moreover, Aloe Vera's natural resistance to pests significantly reduces the need for chemical fertilizers and pesticides, making it a safer and more environmentally friendly crop.

Aloe Vera and Food Security

While not a direct food source, Aloe Vera indirectly contributes to **food security** by improving farmers' incomes and thus enhancing their ability to purchase food and other essentials. Additionally, its use in nutraceuticals and functional food products supports public health. Aloe Vera gel and juice are rich in vitamins (A, C, E, B12), minerals, and amino acids, which help boost immunity and digestive health, playing a preventative role in nutrition-related illnesses.

Aloe Vera and Farmers' Income

From an economic standpoint, Aloe Vera cultivation offers significant potential to increase farmers' income. It is in high demand in the pharmaceutical, herbal, and cosmetic industries both domestically and abroad. With opportunities for value addition—such as creams, gels, juices, soaps, and capsules—farmers can diversify their product offerings and tap into more profitable markets. Moreover, Aloe Vera requires low capital investment, making it an attractive crop for smallholder and marginal farmers. With proper cultivation and market access, Aloe Vera farming can yield three to four times more income per acre compared to traditional cereal crops.

Aloe Vera holds significant potential to contribute to sustainable agriculture and rural livelihoods in Pakistan. With the right policy support, capacity building, and value chain development, Aloe Vera can become a transformative crop that enhances farmers' income, ensures environmental sustainability, and contributes to national development goals.

Fennel

Fennel (*Foeniculum vulgare* Mill), whether wild or cultivated, is found globally and is a member of the Apiaceae family. The seeds of fennel are widely recognized for their antispasmodic, anti-inflammatory, antimicrobial properties, and their ability to promote estrogen. They have various medicinal, therapeutic, and economic applications, including hypoglycemic and estrogenic effects (Singh, 2008). In addition to its carminative benefits, fennel is primarily utilized

as a purgative in combination with liquorice powder. Fennel water shares similar properties with anise and dill water, often mixed with sodium bicarbonate and sweeteners, and is commonly used as a domestic remedy known as 'gripe water' to alleviate flatulence in infants. In the Subcontinent, fennel seeds are consumed raw, occasionally with a sweetener to aid digestion. Further uses are

(1). The kernels of *Foeniculum vulgare* are utilized to address various health issues, including digestive, endocrine, reproductive, and respiratory problems (2). Recognized as one of the world's foremost medicinal plants and among the oldest aromatic crops, fennel holds economic importance and is widely used in healthcare (3). Originally native to the Mediterranean coasts, fennel has become a global herb employed both in traditional medicine and gastronomy since ancient times (4). *Foeniculum vulgare* Mill., a perennial non-woody plant, is a vital resource in traditional medicines and seasonings worldwide (5). As a member of the Apiaceae family, fennel contributes valuable metabolites with applications in medicines, agrochemicals, flavors, perfumes, colors, biopesticides, and food additives (6). Widely recognized for its pharmacological benefits, fennel serves diverse purposes, including digestive aid, diuretic, asthma relief, support for breastfeeding women, diabetes management, lipid level reduction, treatment of edema, anxiety, depression, and gastrointestinal diseases. (7) A significant increase in quantity and quality yields through the suitable practices and chemical constituents could build a necessary contribution to farm and pharmaceutical trade.



Province wise area of fennel in Pakistan

Region	Key Areas/Districts	Climate Type	Soil Type	Notes
Balochistan	Khuzdar, Kalat, Lasbela	Arid to semi-arid	Sandy-loam	Major fennel-producing region due to dry conditions
Sindh	Thatta, Badin, Tharparkar	Arid, coastal	Sandy and saline soils	Suitable for medicinal crops like fennel
Southern Punjab	Bahawalpur, Multan, Rahim Yar Khan	Semi-arid	Loamy to clay-loam	Good irrigation network supports fennel cultivation
Khyber Pakhtunkhwa	D.I. Khan, Kohat (small-scale areas)	Semi-arid to dry subtropical	Alluvial soils	Limited cultivation; potential for expansion

Role in Sustainable Agriculture

Fennel (*Foeniculum vulgare*) plays a key role in advancing sustainable agriculture in Pakistan due to its status as a low-input crop. It requires minimal use of chemical fertilizers and pesticides, thus significantly reducing environmental impact (Ahmad et al., 2021). Its climate resilience allows it to thrive in semi-arid and drought-prone areas, making it particularly suitable for regions such as southern Punjab, Balochistan, and parts of Sindh (Khan et al., 2019). Furthermore, fennel contributes to soil health when incorporated into crop rotation systems, as it helps disrupt pest and disease cycles, reducing dependence on synthetic inputs (FAO, 2020).

Contribution to Food Security

In terms of food security, fennel offers both nutritional and cultural value. It is rich in fiber, essential oils, and antioxidants that support digestive health and boost immunity (Sharma et al., 2018). Its cultural significance in traditional diets and herbal remedies enhances its acceptance among local communities and reduces reliance on synthetic pharmaceuticals (Hussain et al., 2022), thereby promoting health and wellness through dietary means.

Enhancing Farmers' Income

Economically, fennel cultivation presents promising opportunities for increasing farmers' income. There is strong market demand for fennel seeds, essential oils, and herbal products both locally and globally. Value addition through

essential oil distillation and proper packaging can significantly raise profit margins for growers and processors (PARC, 2020). Moreover, fennel has proven export potential, particularly in the Gulf countries, Europe, and South Asian markets, making it a lucrative crop for farmers and entrepreneurs looking to tap into international herbal product demand (TDAP, 2023). With the right support and market access, fennel can become a key crop for sustainable rural development in Pakistan.

Mint

The *Mint* s, member of the Lamiaceae family, contains aromatic and medicinal florae worth for their necessary oils, particularly in cooking, medicinal, and cosmetic industries. Broadly used in spice mixtures and traditional medicine, *Mentha* species— for example peppermint gum and *Mentha spicata*—are full of menthol, menthone, carvone, and other mixtures with antiseptic and fungicidal characteristics. The essential oil derived from *M. spicata*, along with its key component p-menthane, has been shown to effectively inhibit the growth of pathogens. Beyond their antibacterial and antioxidant properties, mint herbs (*M. spicata* and *M. piperita*) are rich in various nutrients. These species also comprise numerous useful phytochemicals such as flavonoids and tannins. Farmed internationally, *Mentha* is mainly cultivated in moderate areas, with the U.S., China and India being the top makers and exporters. Initiating from Europe and the Mediterranean, mint has historical importance and endures to be a vital industrial crop because of

its high necessary oil content.

Role in Sustainable Agriculture

Mint farming provides vast possibility for sustainable agriculture in Pakistan, mainly in Punjab and Khyber Pakhtunkhwa provinces. Its petite growing cycle permits manifold annual crops, enhancing land efficiency. Mint's natural pest-repelling effects offer an eco-friendly substitute to chemical insecticides, whereas its soil-conserving capability supports fight erosion. Moreover, mint is perfect for intercropping with crops such as sugarcane and maize, allowing small agriculturalists to expand income without increasing land use.

Contribution to Food Security in Pakistan

In a country where many rural communities have limited access to healthcare, mint's traditional medicinal uses—for treating digestive problems, fevers, and colds—play a vital role in promoting community health naturally and affordably. As a culinary herb, mint is a staple in Pakistani kitchens, used in chutneys, drinks, and garnishes, enhancing both the flavor and nutritional quality of local diets. Its richness in antioxidants and micronutrients makes it a low-cost contributor to dietary health, particularly important in food-insecure regions.

Enhancing Farmers' Income in Pakistan

Mint farming in Pakistan provides good income chances for small land holder farmers because of constant local needs and increasing export possibilities. Mainly in Punjab, growers are implementing value-added processing for example mint oil condensation and production of herbal tea. The crop helps sustainable agriculture, food security, and environmental agriculture, making it model for rural entrepreneurship.

In spite of the economic and health importance of medicinal plants, Pakistan experiences issues such as environmental degradation, unfettered harvesting, and lack of farming standards. Approximately 700 plant species are threatened, counting significant medicinal herbs. Sustainable use and preservation, particularly in rural areas like Gilgit-Baltistan, KPK, FATA, and Balochistan, need local participation, training, and market entree.

To help this sector, the State Bank of Pakistan

(SBP), through its SBP Banking Services Corporation (SBP BSC), is encouraging financial addition and crop divergence. It offers entree to credit and customized financial products for medicinal crop farming. Government-subsidized schemes such as the Prime Minister's Youth Business and Agriculture Loan program and the Credit Guarantee Scheme for Women Entrepreneurs additional help small growers and women in agri-business. Together, institutional efforts and financing programs offer a strong foundation to develop Pakistan's medicinal plant sector into a key driver of rural development, export growth, and sustainable agriculture. Institutional Support and Financial Incentives for Medicinal Crop Development in Pakistan.

The State Bank of Pakistan (SBP), through its operational wing Banking Services Corporation (SBP BSC), is enthusiastically providing comprehensive agricultural growth under the SBP BSC Vision 2028, which encourages monetary insertion, sustainable development, and modernization. The main emphasis is boosting admittance to finance for non-traditional, high-value crops such as medicinal plants, which help food security, rural progress, and environmental sustainability. SBP BSC cooperates with agriculturalists, banks, agronomy experts, and academia to encourage financial learning, sustainable agriculture, and crop variation. It guarantees application of agricultural credit goals and helps banks in scheming □ customized financial solutions for sectors for example medicinal crop farming.

The government encourages these initiatives through subsidized financing schemes, particularly the Prime Minister's Youth Business and Agriculture Loan Scheme (PMYB&ALS), which supports low-interest □ financing to youth and small agriculturalists for agribusinesses, comprising medicinal crops. The Credit Guarantee Scheme for Women Entrepreneurs additional indorses complete financing by providing women-led agriculture-based enterprises.

Together, these efforts goal to expose the marketable potential of Pakistan's medicinal plant sector by providing entree to investment, helping value chain progress, dropping rural poverty, and enhancing herbal exports. This aligns medicinal

crops with Pakistan's wider aims of green and comprehensive economic progress.

Conclusion

In conclusion, medicinal crops signify mostly unexploited opportunity for encouraging sustainable agriculture, food security, boosted farmer revenue, and long-term progress in Pakistan. In spite of their potential, research and development in this sector persist ignored. There is immense scope for innovation, scientific exploration, and economic investment in medicinal plant cultivation. With a clear and supportive government policy, increased public awareness along with AFLP (Agriculture Financial Literacy Program) by SBPBSC, and the application of modern biotechnological methods, Pakistan can achieve large-scale and sustainable production of high-value medicinal crops. This would not only contribute to environmental conservation and rural empowerment but also lay the foundation for a thriving medicinal plant industry—positioning medicinal crops as a key driver of Pakistan's green economy and sustainable development goals.

Recommendations

1. Develop a comprehensive national policy to regulate the conservation, cultivation, harvesting, and trade of medicinal plants, with clear roles for federal and provincial governments.
2. Establish dedicated research centers and university programs focused on medicinal crops, including their cultivation techniques, pharmacological studies, and value addition.
3. Launch training programs for farmers—

especially in rural and mountainous regions—on sustainable farming, post-harvest processing, and organic cultivation of medicinal plants along with existing targeted AFLP sessions by SBPBSC.

4. Facilitate connections between growers, traders, and exporters. Provide subsidies, low-interest loans, and technical support for entrepreneurs and small-scale growers.
5. Partner with international organizations such as ICMAP and BHMA for knowledge sharing, capacity building, and standardization of herbal products.
6. Support the use of biotechnological tools such as in vitro propagation and genetic conservation to ensure sustainable production and high-quality yields.
7. Implement strict regulations against overharvesting and illegal collection. Promote community-based conservation models in areas like Gilgit-Baltistan, FATA, KPK, and Balochistan.
8. Form provincial and national medicinal plant boards to coordinate efforts, manage databases, and facilitate research, trade, and conservation.
9. Conduct campaigns to educate the public, farmers, and policymakers on the importance of medicinal crops in health, income generation, and environmental sustainability.

Encourage participation of women and marginalized groups in medicinal plant value chains to ensure inclusive economic growth and community development.

Conflict of Interest

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